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## PORTO RICO—ITS CLIMATE AND RESOURCES.

BY

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1. CLIMATE.—The geography, especially the orography, of a country constitutes such an important factor in any basis upon which to build an intelligent discussion or knowledge of the climate, that the reader is urged to precede or accompany a consideration of this discussion with a careful study of a good map of the island. Note first the latitude and longitude, and then observe that the island is rudely rectangular, the greater axis lying almost exactly east and west, and is about one hundred miles in length and thirty-six miles wide, and therefore contains about three thousand six hundred square miles. Note also the existence of a well-defined water-shed beginning near the little town of Maricao, just north of San German, in the southwest corner of the island, and extending eastward so as to conform very closely to the southern and eastern coast lines, and terminating in the famous peak El Yunque. This ridge varies in height from two thousand to four thousand feet, and is so situated as to divide the island into two unequal parts, about one third being on the south side and two thirds on the north side. Both sides of this ridge are deeply corrugated with alternating cliffs and gorges, and many streams—some very properly called rivers—find their way to the sea.

With these data in mind, we are prepared more fully to consider the climatic features of the island.

The climate of Porto Rico is, of course, tropical, but the topography creates decided local climatic differences. These climatic changes when expressed in words or figures appear very insignificant, but to the native or one who has become acclimatized they are decidedly appreciable. In fact, one may hear the native Porto Rican speak of the "rigours of winter," which to one used to northern winters seems amusing; but to one well acquainted with the facts it is not surprising.

Considering now the ordinary daily changes in temperature, we note that the lowest temperature for the day occurs between five and six in the morning; after this hour it rapidly increases up to 10 A. M., and then remains nearly stationary until 1 or 2 P. M., after which it gradually falls until 5 A. M. the next day. The maximum usually occurs about 2 A. M., but may occur any time between

10 A. M. and 2 P. M. The mean daily range—that is, the difference between the maximum and the minimum temperatures—is quite constant throughout the year, but varies at different stations over the island, depending upon location and local surroundings. The figures given are taken from the records at the local office of the U. S. Weather Bureau, at San Juan, and are applicable only to San Juan, but they serve to show the marked regularity which characterizes the climate of Porto Rico. The mean daily change of temperature at San Juan is  $11.5^{\circ}$  F., taking an average for the year; while there is less than  $2^{\circ}$  difference in the mean for the various months. The inland and mountainous districts have a daily range of from  $13^{\circ}$  to  $23^{\circ}$ . These daily temperature changes are, of course, subject to sudden but temporary fluctuations, as during the passage of a thunderstorm, when there may be a drop of  $8^{\circ}$  to  $15^{\circ}$  in the temperature.

As regards the yearly changes of temperature, it will be observed from the accompanying table of meteorological data, taken from the records of the U. S. Weather Bureau, that the month of January has the lowest mean temperature, while that of February and March is but slightly higher, and all three have very nearly the same minimum. The mean temperature gradually increases from March to August, and then begins to decrease. Although the month of August has the highest mean, it will be observed that the highest temperature for the year occurred in May. In 1900, the highest,  $93^{\circ}$ , occurred in April; and in 1889, the highest,  $91^{\circ}$ , occurred in June and September. It is also interesting to note that although August has the highest mean, September has the highest “mean maximum,” and that the difference between the highest temperature for the year,  $93^{\circ}$ , and the lowest,  $67^{\circ}$ , is  $26^{\circ}$ , while the difference between the highest mean,  $80.4^{\circ}$ , and the lowest,  $75.2^{\circ}$ , is only  $5.2^{\circ}$ , all of which go to show the erratic nature of this climatic feature within its narrow limits.

As before stated, the various sections of the island experience different degrees of heat, depending upon local conditions, but a temperature of  $100^{\circ}$  is very rare. In fact, such a temperature has not occurred at San Juan since the establishment of the U. S. Weather Bureau office in 1898, and has been reported from other stations on the island but twice within that time—once from Cayey and once from Comerio in 1901. A temperature as low as  $50^{\circ}$  is occasionally reported from stations situated upon the mountains. Thus the island really has a range of  $50^{\circ}$ . The decrease of temperature with elevation is about  $4^{\circ}$  for each 1,000 feet of ascent.

The relative humidity of the atmosphere is at all times very high, and it is subject to the same regular daily changes, but, of course, just the reverse of the temperature changes. That is to say, the humidity is highest about 5 A.M., and then decreases rather rapidly until midday, when it begins to increase gradually until 5 A.M. the next day. This constant high humidity is very trying on the health of persons used to cold climates. The prevailing winds are easterly, and are fresh to brisk during the day and light during the night. These winds are the northeast trades, modified more or less by local conditions, and they constitute a most fortunate feature of Porto Rican climate.

TABLE I.

METEOROLOGICAL DATA RELATIVE TO SAN JUAN, PORTO RICO.

	TEMPERATURE.					MEAN RAINFALL.
	MEAN.	MAX.	MEAN MAX.	MIN.	MEAN MAX.	
January.....	75.2	84	81.6	67	69.9	2.97
February....	75.6	89	83.3	67	70.7	2.37
March.....	75.6	87	82.7	67	70.9	2.32
April .....	77.1	90	84.8	70	72.5	3.59
May .....	78.8	93	86.3	70	74.0	4.67
June .....	79.2	90	85.7	70	74.6	4.87
July.....	79.9	89	85.0	70	74.6	5.74
August .....	80.4	91	86.9	70	75.4	5.87
September...	80.3	92	87.2	71	75.4	5.13
October .....	79.0	88	86.3	71	74.5	6.18
November...	78.2	89	84.0	70	72.7	6.50
December...	76.5	86	82.4	68	71.5	4.30
YEAR.....	78.0	93	84.7	67	73.1	54.50

The mean temperatures are based upon a three years' record, but the figures relative to the maximum and minimum temperatures are those of 1901.

Coming now to the question of rainfall, let it first be understood that Porto Rico has no "dry" and "wet" seasons in the sense that at certain times of the year the rains set in and continue uninterruptedly for a season, giving us the wet, dreary days common in parts of the United States, when one does not dare to venture out. Such weather is absolutely unknown in Porto Rico. The only difference between the fall of one part of the year and another is in

the amount of the fall. The rain falls in quick, sharp showers, more like a "spring shower" in the United States. The clouds often appear suddenly, the rain falls rapidly, and at times in great quantities, but the shower soon passes over, and the weather is as fine as a spring morning. This is true the year round.

By reference to the table above mentioned, as well as to Figure 1, a very correct idea of the rainfall of the island may be had. The data in the table apply to San Juan, but the graphic presentation in the figure gives the true distribution through the year for any

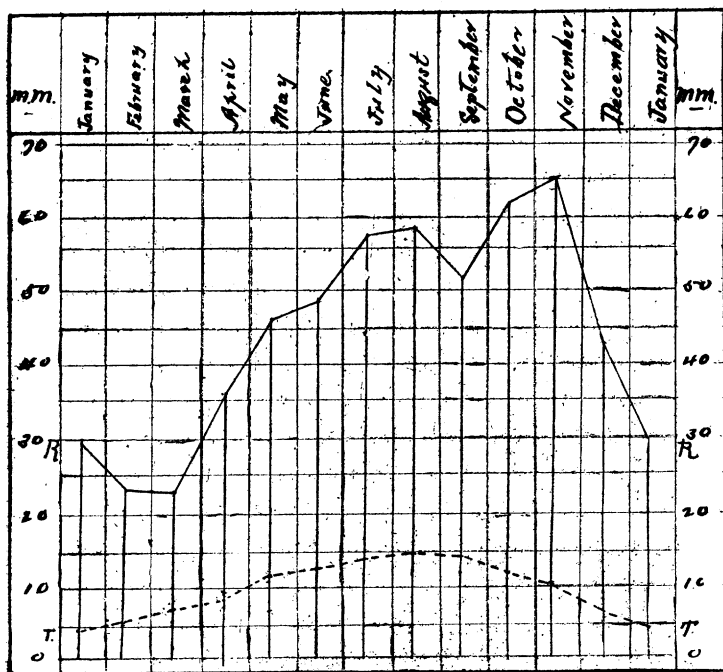


FIG. 1.—*R*. Graphic presentation of the average monthly rainfall at San Juan, P. R., based upon twenty-six years' record. *T*. This line represents the departure of the monthly mean temperature from the annual mean, supposing line "10-10" to represent the annual mean, 78.0° F. Scale used: 1mm=0.10 inch of rain, or ½ degree of temperature.

part of the island. As will be seen, the months of January, February, and March have the least averages, and October and November the greatest. Note the gradual increase in the monthly averages from March to November (excepting September, when a very curious drop occurs) and the rapid decline after November.

As intimated, the rainfall is not evenly distributed over the island. In the neighbourhood of Luquillo, in the northeastern portion of the island, there is a yearly fall of more than 150 inches;

while along the central, elevated portions a fall of more than 100 inches is not uncommon. That portion of the island south of the water-shed receives the least rain, the average for the district being a little less than 50 inches; while many places often experience severe drouths, rendering irrigation quite necessary. North of this divide the fall is heavier and more constant. The average for San Juan, 54.50 inches, may be taken as fairly representative of this section.

The rains fall almost daily; but evaporation is very rapid during the day, and consequently the showers which fall at night are the most beneficial. The rains are about equally divided between the day and night.

II.—RESOURCES.—Practically all the industries of the island, as well as the principal sources of wealth, come under one of the following heads—viz., Agriculture, Stock-raising, Manufacturing, and Mining. There is some cutting of timber, but this is not considerable. So we will consider these heads separately and in detail.

I. AGRICULTURE.—Using this term to include fruit-growing, this industry at once far surpasses all others in importance. In fact, it is the mainstay of the island and the support of the great majority of the inhabitants. Almost all available land is now under cultivation, and even the hill and mountain sides are being planted in crops. The lowlands, or playas, lying between sea and mountain, and the river valleys, constitute by far the most valuable agricultural lands. According to the census of 1899, there were then in the island 39,021 farms, with an average of 45 acres to the farm; but an average of only 12 acres per farm was in cultivation, the rest being devoted to pasture.

We take from the Report of the Commissioner of the Interior for Porto Rico, 1900-1901, the following facts as to how the lands of the islands are employed for agricultural and other purposes:

Sugar cane.....	82,678 acres
Coffee.....	166,164 acres
Tobacco.....	13,704 acres
Miscellaneous crops.....	201,815 acres
Pasturage.....	1,203,206 acres
Woodland.....	165,671 acres
Uncultivated lands.....	138,348 acres

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Total..... 1,971,586 acres

At least three fourths of the island is in farms, and certainly as much as one fifth of the total area is under cultivation.

Before going more into detail as to the leading crops raised, we wish to give a few facts relative to the soils of the island. For this information we are indebted to Mr. Frank D. Gardner, Special Agent in charge of the U. S. Agricultural Experiment Station at Mayagüez.

Around the coast is a narrow fringe of coral sand, varying in width from a few rods to a mile, and consisting of level stretches or sand-dunes, and having a flora very different from that of the mountains. There are but few species. This strip is valuable only for raising cocoanuts and pineapples.

Between the coral sand and the mountains is a level tract of land, known as the *playa*, and varying in width from the fraction of a mile to several miles. The texture of this soil varies from sand to clay loam, and it is alluvial in character, having been brought down from the mountainous interior. This, the most fertile part of the island, is devoted to the growing of cane and to grazing purposes. There are, perhaps, as much as 200,000 acres of this land. It has been planted in canes for many years, and is much impoverished in many places; but in times of flood, as during the hurricane of 1899, it is enriched by the overflow from the mountains, bringing down silt and fine sand or organic matter.

We may divide the remaining portion of the island into the foothills and the mountains proper. The former, along the north side, as well as some of the mountains, are largely of coral limestone, and give rise to soils that vary in colour from black to red, the dark colour being due to organic matter and the red to iron compounds. These soils are shallow, except in the bottom of ravines and sink-holes, which are common. The hillsides are often very steep. Crevices are numerous and deep, and, when filled with soil, furnish good opportunities for the growth of plants. The rougher hills are too stony to be of much agricultural value, but those that are more nearly covered with soil make excellent grass lands. When well drained these lands are suited to the growth of citrus fruits. Most of the higher mountains in the interior and toward the south are covered with a deep layer of soil, which is adapted principally to the cultivation of coffee, citrus fruits, and minor crops.

The fertility of these lands varies greatly according to texture, exposure, and length of time in cultivation. Where sandy in character, when put under cultivation it rapidly loses its fertility by the leaching of heavy rains, and the farmers of the interior who

grow minor crops change fields every few years. The clayey soils are not so readily impoverished by the rains.

So much, then, for the soils. We will now take up some of the leading crops.

(1) *Coffee*.—Prior to the great hurricane of August, 1899, this crop was by far the most valuable on the island, and at present it bids fair to assume the first place again in the near future. Up to 1899 about 180,000 acres were devoted to this crop, and the normal yield was 26,380 tons of marketable coffee. This yield was reduced to 6,700 tons in 1899 by the hurricane; but the plantations have so far recovered that the estimated acreage of the present (1902) crop is 166,000 acres, with a good prospect of a yield of 24,230 tons. It is confidently believed that the yield will soon reach the normal of former years, and perhaps surpass it, as the old plantations are being rapidly restored and some new ones being put out. With favourable markets and a fuller knowledge of the merits of Porto Rican coffee, this crop will, beyond all question, be the greatest crop of the island.

The best coffee is grown on the hills and low mountains, as the plant there finds a suitable soil and the requisite protection from sun, rain, and winds, being associated with larger trees. The coffee soils vary in composition, but the best seems to have a very fine clay ingredient, and, when wet, is as slippery as soap. The yield, of course, varies according to soil and cultivation; but, taking into account these varying conditions, a yield of 10 to 14 quintals per hectare is perhaps a fair average.

(2) *Sugar*.—This is also an industry of great import to the island; in fact, many believe it to surpass the coffee industry in its present importance and future possibilities. In 1900 there were about 82,678 acres planted in cane; and in 1901 the acreage was about 91,000 acres. The crop harvested in 1900 was 65,500 tons of sugar; and in 1901 it amounted to 95,850 tons. It is estimated that the present crop will reach 105,000 tons, or very little short of that of 1884, which was the largest crop ever grown on the island, reaching the sum of 108,000 tons. With the establishment of large factories and an increased acreage, there is every prospect of doubling the yield of sugar in a very few years.

(3) *Tobacco*.—The tobacco crop is rapidly assuming an important place. The acreage has been largely increased within the last year, and the indications are that the present crop (1902) will surpass that of any former year, notwithstanding the fact that seeds



were scarce at sowing time and subsequently unfavourable weather militated against the crop. Planters confidently predict that in a few years the island will be famed for this product alone. Effort is being made to introduce the best varieties and employ the most improved methods in the cultivation and handling of the crop. The chief varieties now cultivated are Guacharo, Virginia blanca, Corazon de Vaca, and Cubarro.

(4) *Fruits*.—Hitherto pomology has been practically an unknown art in Porto Rico. Nevertheless, the fruits of the island have been and are of very great economic value to the inhabitants, and may become a source of no small income. This subject is so large as to demand a separate discussion, and can only be touched upon here. The value of the export of fruits has now reached the sum of \$100,000 per year. There are many tropical fruits, such as the guava, that are too perishable for transportation to northern markets except in some manufactured form.

There are several varieties of the orange in Porto Rico, some of which are of an excellent flavour, and this, too, although very little effort has been made to improve the quality. Heretofore the yield of such trees as grew spontaneously on the wild lands has been sufficient to satisfy local demand, and little or no effort has been made to extend or improve the crop.

The banana grows rapidly and bears abundantly, but the lack of a market has limited the production to supplying home consumption. Several varieties are met with, such as the *musa sapientum*, *musa chinensis*, *musa paradisiaca*, and *heliconia Bihai* (wild plantain), and, as a rule, the flavour is unsurpassed.

The cocoanut abounds, but is not very suitable for shipment to northern markets, as it contains too much "milk" and not enough "meat." A better variety might be introduced, and would doubtless give satisfactory returns.

There are other minor fruit crops, such as pineapples, lemons, limes, guava, alligator pears, and so on, cultivated only in so far as the needs of the local markets require.

2. *STOCKRAISING*.—This has long been an important and remunerative industry. Cattle, horses, mules, sheep, goats, and hogs are raised not only for local use but for export as well. In 1897 there were in the island about 303,612 head of cattle, valued at six million pesos; 67,751 horses, valued at two million pesos; 4,467 mules, worth about 134,000 pesos; and other live stock, aggregating in

value about 100,000 pesos more. Thousands of acres of land are devoted to pastures, and the pasturage is good the year round.

3. **MANUFACTURING.**—Porto Rico has, of course, a number of sugar factories, one or two of which are new in every respect. Cigars, cigarettes, and straw hats are made, and there are three or four match factories, two or three soap and vermicelli factories, a number of distilleries, several ice plants, six foundries, a sash and door factory, and several bottling (soda water) establishments.

4. **MINING** —There are some eighty mining concessions in the island; but these are not in operation, excepting one or two gold placers and some salt works. The gold placers at Corozal have been worked, but the yield scarcely justifies the expense. Deposits of iron ore of the first quality are practically inexhaustible, and are found at many places on the island, but the deposits known as "Iron Hill," near the east coast, and those near Arroyo, are famously rich. Many other minerals, such as copper, galena, jet, lignite, pyrolusite, electrum, bismuth, nickel, and quicksilver have been found, but not in paying quantities.